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&
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EX PARTE OR LATE FILED

July 12, 1995

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Ex Parte Presentation--RM-8658

Dear Mr. Caton:

On Tuesday, July 11, 1995, Helping Equalize Access Rights in Telecommunications Now (HEAR-IT NOW) demonstrated CDMA and GSM digital wireless technologies at the FCC. During the demonstrations, FCC staff members were able to use a GSM base station operating in the 1800 MHz band at .25 watts, and a CDMA handset operating in the 800 MHz band at .25 watts, to examine the effects of the transmissions on hearing aids. Speaking at the demonstrations were Brenda Battat of Self-Help for Hard of Hearing People, Susan Coffman of the Alexander Graham Bell Association for the Deaf, and Michael Ruger of Baker & Hostetler. James I. Valentine and Kathy Kemper of the Wireless Communications Council, as well as Guy Vander Jagt of Baker & Hostetler and the undersigned, briefly attended as well.

The demonstrations were held during a two hour period. Attached is a list of FCC staff members who attended the demonstrations at some point during the two hour period. Also attached is a copy of the materials distributed at the demonstrations. In addition to the materials attached, copies of HEAR-IT NOW's Petition for Rule Making (RM-8658) were distributed as well.

Pursuant to Section 1.1206 of the Commission's Rules, an original and one copy of this letter and the attachments are being filed with your office. If you have any questions concerning this submission, please contact the undersigned.

Sincerely yours,

Frederick H. Graefe

Attachments

cc: (without attachments)
Rudolfo M. Baca
Angeleta Banks
Kimberly M. Baum
Michael Buas
Dennis Butler
Errol Chang
Robert Cleveland
Rita Cookmeyer
Mike Crowe
Thomas P. Derenge
Linda Dubroof
Christine Enemark
Sonia Greenaway
Kathleen Ham
Jay Jackson
Donna Kanin
Linda Kinney
Raymond LaForge
Charlene Lagerwerf
Mike Lewis
Greg Lipscomb
Irene Longin
Timothy Maguire
Jay Markley
Tim May
Maura McGowan
Lisa Minard
Herbert Neumann
Roger Noel
Lawrence P. Petak
Mark Rubin
Anthony Serafini
Priya Shrinivasan
David Siddall
David Siehl
Daniel Stanks
Alan R. Stillwell
David Sylvar
Jerry Ulcek
Hugh L. Van Tuyl
Gerald P. Vaughan
Bertram F. Weintraub
Stanley P. Wiggins
Allen K. Yang

HEAR-IT NOW

Helping Equalize Access Rights In Telecommunications Now

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SUMMARY OF HEAR-IT NOW PETITION FOR RULE MAKING

Helping Equalize Access Rights in Telecommunications Now, or HEAR-IT NOW, is a coalition of groups formed to promote equal access by the Nation's four million hearing aid wearers to advanced communications services. On June 5, 1995, HEAR-IT NOW filed a petition for rule making with the Federal Communications Commission asking that agency to amend its rules to require that broadband Personal Communications Services (PCS) devices capable of voice transmission or reception be hearing aid-compatible, just as existing "wireline" telephones are hearing aid-compatible.

PCS licensees are in the process of selecting basic operating systems for their new PCS services. HEAR-IT NOW noted that one available operating system, the Global System for Mobile Communications, or GSM, has been proven to be incompatible with most hearing aids. Studies conducted in Denmark, the United Kingdom, New Zealand and Australia show that operation of a GSM telephone by a person wearing a hearing aid will create interference that, in turn, will cause the hearing aid to emit a loud buzzing noise. This noise temporarily disables the hearing aid and can cause discomfort to the person wearing the aid. Interference can also result if someone standing near a person wearing a hearing aid uses a GSM telephone.

The European solution to this problem has been to require hearing aid manufacturers to design new hearing aids that are protected against GSM interference. To date, however, no such hearing aids have been developed. Even if such hearing aids are developed, people who wear hearing aids would be forced to replace their existing hearing aids--a potentially expensive proposition, as the average hearing aid can cost more than six hundred dollars.

HEAR-IT NOW has asked the FCC to mandate hearing aid compatibility for PCS systems now, before PCS systems are introduced, in order to avoid the difficulties associated with future retrofitting of wireless communications to permit hearing aid compatibility.

The FCC is collecting public comments on the HEAR-IT NOW petition until Monday, July 17. After that date, the FCC will decide whether to propose rules to mandate PCS compatibility with hearing aids. Comments may be sent to the Office of the Secretary, Federal Communications Commission, 1919 M Street, N.W., Room 222, Washington, D.C., 20554.

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FACT SHEET ON INDEPENDENT STUDIES ATTACHED TO HEAR-IT NOW PETITION FOR RULE MAKING

Interference with Hearing Aids Caused by GSM Digital Cellular Telephones and DECT Digital Cordless Telephones, National Telecom Agency, Denmark, June 28, 1994.

- Researchers determined that 62% of hearing aid wearers will find that usage of a GSM telephone in either ear creates interference [page 24].

- 18% of hearing aid wearers will detect interference created by other persons using GSM telephones [page 24].

- The study concludes that "(i)t is highly uncertain" that behind-the-ear hearing aids can be designed to permit the use of GSM telephones. While in-the-ear hearing aids may offer additional prevention against interference, the study notes that such devices are not effective for hard of hearing individuals [page 26].

FMC and the New Modulation Technologies, Ole Lauridsen, Director, Telelaboratoriet, TELECOM, Denmark, May 1994.

- GSM-created interference has been observed to affect a number of devices, including hearing aids, telephones and radios, as well as more sophisticated digital devices such as cash registers, meters, credit card terminals, car electronics and remote control devices [page 5].

- "The interference to hearing aids due to cellular radio services is unacceptable because it is a general matter of principle, that people with a handicap shall have access to all public services to the greatest extent possible, and they shall not suffer additionally due to public activities." [page 7].

Digital Cellphones and Interference with Hearing Aid Users, National Audiology Center, Auckland, New Zealand, August 1993.

- In a study of twenty-nine hearing aid users, twenty-seven detected interference when using a 2 watt GSM telephone [Table 3, page 10].

- Recommendations included informing consumers about the possible effects on hearing aid users associated with GSM-powered cellular phones, and informing hearing aid users that they will be unable to use the phones [page 17].

Interference to Hearing Aids by the New Digital Mobile Telephone System, Global System for Mobile (GSM) Communications Standard, Ken H. Joyner et al., March 30, 1993.

- o Shielding of hearing aids "is likely to be impractical" [page 4].
- o "Widespread use of the new GSM mobile telephones may make existing hearing aids useless for much of the time" [page 5].

FMC Considerations for Digital Cellular Radio and Hearing Aids, Jon Short.

- o "[T]he hearing aid user will be unable to use a portable [GSM-powered] digital cellular telephone" [page 2].
- o The study predicts daily bursts of interference even among hearing aid users who do not use a GSM telephone [page 2].

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PARTIAL TRANSCRIPT OF "TOMORROW'S WORLD" BROADCAST OF OCTOBER 29, 1993 BBC-TV

WOMAN: In the '80s, the most annoying thing a mobile phone could do was go off unexpectedly in a restaurant. But the latest generation of digital mobile phones can cause more serious problems.

This hearing aid has been set up with a microphone so that [voice takes on metallic sound] you're now hearing sounds through it. It's a pretty standard one. Just listen to this [buzzing sound].

WOMAN [speaking over loud buzzing]: How this will sound to somebody wearing one of these depends on various things.

I think I'll switch that off. That's better.

Now, I'll say that again. How that sound would appear to someone wearing one of these depends on their hearing, as well as how powerful the phone is and how far away it is. But you have the general idea.

It happens because of the way the digital pulses are transmitted. Stray signals are produced that can interfere with almost any piece of equipment with an amplifier: personal stereos, TVs, radios. But hearing aids seem particularly susceptible.

LORD ASHLEY [President, Royal National Institute for Deaf People]: Many deaf people are furious because they're denied the right to communicate with others because of mobile telephones. It's ironic that this improvement in communication by mobile telephones should damage communication for deaf people.

WOMAN: So, how come this happened? Well, the phone companies say they aren't actually to blame. They build the phones to meet standards set by the European Community in the mid-'80s.

Two years ago the Department of Trade and Industry did warn that there were going to be problems with the new phones, but they went on to issue the transmission licenses to the telephone companies.

LORD ASHLEY: Well, I think that the manufacturers of hearing aids and of telephones must resolve it. And although so far that they're meeting technical standards, they've not been meeting the standards of deaf people.

WOMAN: What can be done? So much time and effort has been invested in this digital network that it will never be changed. And unfortunately for the two million users of hearing aids in this country, it's virtually impossible to adapt existing hearing aids.

The only answer is a different design. And a group, including the hearing aid manufacturers and the phone operators, has already started working on a new set of standards for hearing aids. But, as these phones become more widespread, the promise of future regulations does nothing to the problems they're causing now.

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SENATE FLOOR STATEMENTS ON GSM DANGERS

The attached discussion on the dangers of GSM technology to hard of hearing individuals who wear hearing aids took place between Senate Democratic Leader Thomas A. Daschle and Commerce Committee Ranking Democratic Senator Ernest F. Hollings on June 14, 1995, in the U.S. Senate.

This provision enables cable operators not to be prematurely deregulated under the effective competition provision if, for example, only a single channel of video programming is being delivered by telco, video, and dial tone providers in an operator's market.

What the bill does: The basic tier, broadcast and PEG, remains regulated until, one, telco offers video programming, or, two, direct broadcast satellite, or any other competitor reaches 15 percent of the market penetration.

I think that is very important because the basic tier remains regulated until the telco in the area has competition or until there is at least 15 percent of a direct broadcast satellite.

The upper tiers of cable rates are subject to bad actor review when the price of program packages significantly exceeds the national average. I have been in some parts of the country where you see a cable rate that is much higher, sort out of the blue, and I think that under this legislation that could fall under the so-called bad actor provision of the legislation.

The point we are making is that, as we move toward deregulation of these cable rates, there are safeguards built into this bill.

I am very concerned that the Lieberman amendment would undo the carefully crafted compromise on cable deregulation that has been agreed to by Democrats and Republicans, and we have had several votes in committee and on the floor already. We have the leadership packet. This would tend to unravel all of that at this late moment.

The fact of the matter is that rates continue to rise with regulation. Cable rates will continue to increase with regulations. Indeed, they have been increasing with regulations. The FCC rules allow rates to increase for inflation, added program costs, new equipment charges, and other factors.

Actual and potential competition spurred by our bill will result in lower cable rates.

I have said that, if we can pass this bill, we will have much lower cable rates than we would under a regulated system because we will have more providers, we will have direct broadcast satellite, we will have the video dial, and we will have the opportunity for utilities to come into the television market.

We are really talking about, with this type of regulation, the 1950's and 1960's and 1970's when maybe you could conceivably say some of this was necessary when you just had one or two providers. But in the 1990's and on into the year 2000, we will have a broad range of competition. I hope that we can take advantage of that. It will result in lower cable rates.

Regulation harms the cable industry. In 1994, for the first time ever, cable revenues remained flat—$23.021 billion in 1993, and $23 billion again in 1994. Cash flows for major companies declined. TCI, $60 billion; Time Warner Cable, $46 billion; Comcast, $30.1 billion; Cox, $27.2 billion.

Cable stock values dropped 10.1 percent between December 1993 and April 1995 while the S&P and NASDAQ indexes rose by 12.2 percent and 14 percent, respectively. That is about a 20-percent spread.

During the last year 16 major cable companies, representing 20 percent of the industry, serving 12 million subscribers have sold or announced their intentions to exit the industry.

Capital raised for public debt and equity offerings declined 81 percent in 1994, $8.6 billion in 1993 to $1.6 billion in 1994.

According to A.C. Nielsen, subscriber growth rates declined from 3.14 percent in 1993 to 2.85 percent in 1994.

Existing and potential competition: Direct broadcast satellite is the fastest growing consumer electronics product in history with 2,000 new subscribers a day projected to grow to 2.2 million subscribers by year's end and over 5 million by 2000.

Due to program access, direct broadcast satellite offers every program service available on cable plus exclusive direct broadcast satellite programming, such as movies and sports; for example, 400 NBA games this season and 700 games next season.

Cable also faces competition from 4 million C-band dishes.

Wireless cable has 600,000 subscribers, expected to grow 158 percent in 2 years to 1.5 million and to 3.4 million by 2000. Bell Atlantic, NYNEX, and PacTel have recently invested in wireless cable.

So the point is there are new services being offered. There is new competition coming forward.

Telcos have numerous video programming trials all over the United States. Meanwhile the Clinton/Gore administration continues to fight in court to keep the cable-telco ban firmly in place.

Cable deregulation is a prerequisite for competition in telecommunications.

A central goal of this bill is to create a competitive market for telecommunications services.

Cable television companies are the most likely competitors to local phone monopolies, but in order to develop advanced, competitive telecommunications infrastructures, cable companies must invest billions in new technologies.

Federal regulation of television has restricted the cable industry's access to capital, has made investors concerned about future investments in the capable industry, and reduced the ability of cable companies to invest in technology and programming.

Concerns about cable rate increases should be mitigated by cable's new competitive pressures from direct broadcast satellite services and from telco-delivered video programming.

Deregulation of cable television services is a prerequisite to bringing competition to telecommunications and is essential to making the competitive model embodied in S. 652 viable.

Cable systems pass over 96 percent of Americans homes with coaxial cables that carry up to 900 times as much information as the local phone company's twisted pair.

Cable companies are leaders in the use of fiber optics and digital compression technology.

Cable's high-capacity systems will ultimately provide virtually every type of communication service conceivable and allow consumers to choose between competing providers of advanced voice, video, and data services.

Mr. President, I feel very strongly that we have reached a proper balance regarding cable in this bill, and to adopt the Lieberman amendment would undo that package that has been worked out.

I also feel very strongly that the American public will benefit from what we are doing here. I mentioned earlier that I have received 500 letters from the small business people at the White House Conference on Small Business who want to pass the Senate-passed bill and also urge President Clinton to endorse the Senate-passed bill.

I think that we all want that procompetitive deregulatory environment. Everybody says that. But many of the folks out there are arguing to preserve regulation. I frequently see large companies using Government regulation to block out competition.

I look upon this telecommunications area as a group of people in a room with a huge buffet of food stacked on the table. But they are all worried that somebody else is going to get an extra carrot. I think we are going to find there is plenty for all, and the consumers will benefit with lower telephone prices, lower cable prices, more services, more services for senior citizens, more services for farmers, and our small cities will be able to flourish.

And it is my strongest feeling that we should continue, as we have done all day, to defeat these amendments tomorrow. We had a very good day today and yesterday in terms of holding this committee bill together.

I see one of my colleagues is in the Chamber and wishes to speak. I am glad to have any speakers. We are trying to move forward. I thank you very much.

I yield the floor.

Mr. DASCHLE. Mr. President, this debate on S. 652 has clearly demonstrated the potential of emerging telecommunications technologies. It is truly exciting to contemplate what this legislation could mean for American society.

A particularly intriguing new development in the telecommunications field is the creation of personal communications service [PCS]. These devices will revolutionize the way Americans talk, work, and play.

While this new technology opens new vistas for personal communications services, its emergence also highlights the potential downside of entering untested areas. Specifically, concerns

have been raised about the potential side-effects of some new PCS technology on other devices such as hearing aids.

Recently, the Government completed an auction that netted $7 billion for the right to provide advanced digital portable telephone service. It is my understanding that some of the companies that obtained these PCS licenses have considered utilizing a technology known as GSM—global system for mobile communications. I am informed that people who wear hearing aids cannot operate GSM PCS devices, and some even report physical discomfort and pain if they are near other people using GSM technology.

It should not be our intent to cause problems for the hearing impaired in promoting the personal communications services market. It is my view that the Federal Communications Commission [FCC] should carefully consider the impact new technologies have on existing ones, especially as they relate to public safety and potential signal interference problems. An FFC review is in keeping with the intent of S. 652, which includes criteria for accessibility and usability by people with disabilities for all providers and manufacturers of telecommunications services and equipment.

Mr. HOLLINGS. Will the Senator yield?

Mr. DASCHLE. I will be glad to yield to the honorable ranking member of the Commerce Committee.

Mr. HOLLINGS. I thank the Senator for yielding and support his suggestion that the FCC investigate technologies that may cause problems for significant segments of our population before they are introduced into the U.S. market. Such review is prudent for consumers, and it will help all companies by answering questions of safety interference before money is spent deploying this technology here in the United States.

Four million Americans wear hearing aids, and the Senator from South Dakota has raised an important issue. GSM has been introduced in other countries, and problems have been reported. It is reasonable that these problems be investigated before the growth of this technology effectively shuts out a large sector of our population.

Mr. DASCHLE. I thank the Senator for his remarks, and would also like to commend his role in bringing telecommunications reform to the floor. His leadership and patience throughout this 3-year exercise that has spanned two Congresses is well known and widely appreciated.

Mr. President, the public record indicates that if companies are allowed to introduce GSM in its presemt form, serious consequences could face individuals wearing hearing aids. I would urge the FCC to investigate the safety, interference and economic issues raised by this technology. I also would urge the appropriate congressional committees to consider scheduling hearings on this issue.

AMENDMENTS NO. 1256 AND 1257

Mr. HOLLINGS. I would direct a question to my colleague with regard to the Stevens amendment on expanded auction authority for the FCC, as amended by the Pressler amendment. These amendments will auction spectrum currently assigned to broadcast auxiliary licensees, and were adopted by voice vote Wednesday evening. This bill now conforms with the Budget Act. Specifically, I do not believe that it is the intention of the sponsors to impede the ability of local broadcasters to continue to deliver on-the-spot news and information.

Mr. STEVENS. That is correct. Several concerns have been raised about auction of certain spectrum which we intend to address as this bill proceeds to conference with its companion bill in the House. In addition, some of these same concerns will be considered within the budget reconciliation bills later this summer. Therefore, we will continue to review these provisions to determine whether the newly-assigned spectrum will adequately satisfy the needs of electronic news gathering, what, if any, interference problems will arise, and how the costs of such transfers should be borne.

Mr. HOLLINGS. I thank my colleague for his comments.

MONOPOLY TELEPHONE RATES

Mr. GLENN. Mr. President, I rise in support of Senator KERREY's monopoly telephone rates amendment. This amendment offers critical protection for ratepayers from potential multibillion rate increases for telecommunications services during the transition to effective local competition.

In mandating price flexibility and prohibiting rate-of-return regulation, section 301 of the bill also prohibits State and Federal regulators from considering earnings when determining whether prices for noncompetitive services are just, reasonable, and affordable. While the Federal Communications Commission [FCC] and many State commissions have instituted various price flexibility plans, most of those plans involve some consideration of earning. If regulators are prohibited from considering the earnings factor when determining the appropriateness of prices for noncompetitive services, the captive ratepayers of these services will be subject to unwarranted rate increases.

Mr. President, this amendment does not change the bill's prohibition on rate-of-return regulation. The amendment would simply allow State and Federal commissions to consider earnings when authorizing the prices of those noncompetitive services. In this way, the amendment provides a safeguard against excess rate impacts in the future.

Mr. President, the monopoly telephone rates amendment recognizes that it is appropriate and in the consumers' interest for State regulators to continue to have a roll in determining the price of noncompetitive services in their States, and in having the discretion to consider the earnings of the local telephone company. Approximately 75 cents of every dollar consumers spend on their overall telephone bills is for calls made within their State. The goal of local telephone competition advanced in this legislation will not be achieved overnight. In the interim, State regulators should have the authority to consider a company's earnings before setting the price level of noncompetitive services. I urge my colleagues to join me in voting for this amendment.

PREEMPTION OF STATE-ORDERED INTRALATA DIALING PARITY

Mr. FEINGOLD. Mr. President, as an original cosponsor of the amendment filed yesterday by the Senator from Vermont [Senator LEAHY], amendment number 1289, I want to discuss the important issue of intraLATA dialing parity.

Mr. President, Senator LEAHY's amendment was very simple. It would have merely clarified the rights of the States to implement pro-competitive measures for telecommunications markets within their State borders, a role which we have always provided to our States. As is often the case in other policy areas, many States, including Wisconsin, are ahead of the Federal Government in deregulating telecommunications markets. In the case of my State, efforts to begin deregulation of telecommunications markets have been on-going for many years, culminating in a major telecommunications bill passed by Wisconsin's State legislature last year and signed by our Governor.

Unfortunately, while S. 652 has the laudable goal of increasing competition in all telecommunications markets, without the changes that the Senator from Vermont and I are promoting, it would actually cripple existing State efforts to enhance competition in markets within their own borders. The legislation would prevent States from ordering intraLATA dialing parity in local telecommunications markets until the incumbent regional bell operating company is allowed access to long distance markets.

IntraLATA dialing parity is complicated phraseology for a very simple concept. Currently, for any long distance calls that consumers make within their own LATA or local access and transport area—also known as short-haul long distance—are by default handled by the local toll provider. In order to use an alternative long distance company to make a short-haul long distance call, a consumer would have to dial a long string of numbers to access that service, in addition to the telephone number they must dial. For most consumers, that is a inconvenience they simply will not tolerate and

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SUMMARY OF ATTACHED PACEMAKER STUDIES

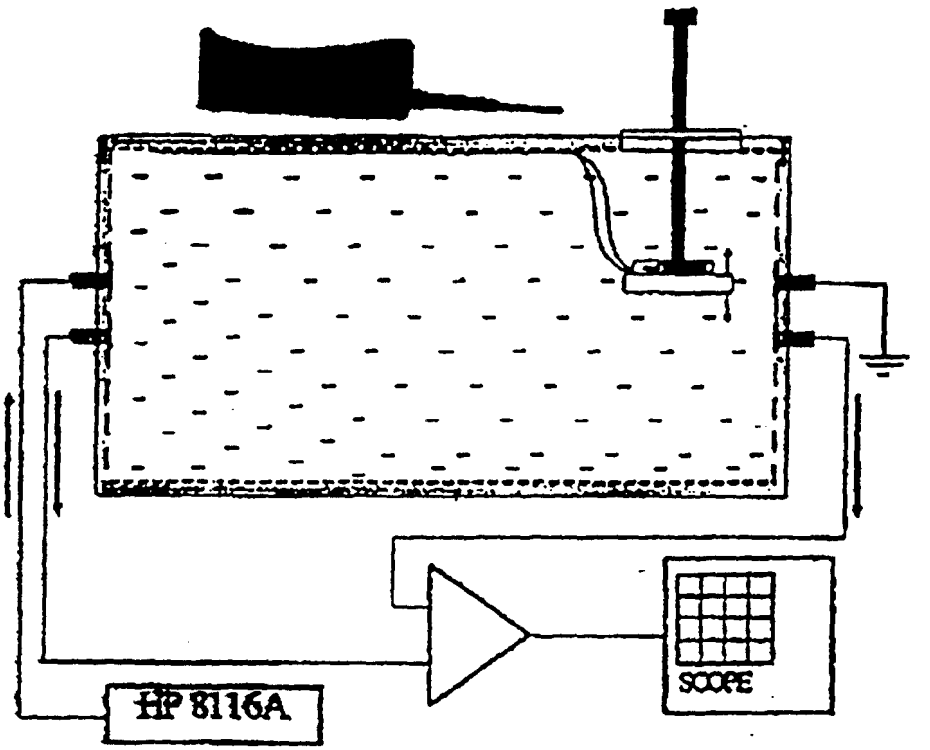
- Istituto Superiore di Sanita, Rome, Italy, GSM Cellular Phone Interference with Implantable Pacemakers: In Vitro and In Vivo Observations.
  - Electromagnetic interference created by GSM devices "could be dangerous for pacemaker dependent patients" [page 8].
- Swiss Telecom, Effects of TDMA-Modulated Hand-Held Telephones on Pacemakers.
  - GSM telephones created interference to 7 out of 38 pacemakers tested [page 7].
  - Use of such telephones not recommended for patients with implanted pacemakers [page 9].

GSM CELLULAR PHONE INTERFERENCE WITH IMPLANTABLE PACEMAKERS: *IN VITRO* AND *IN VIVO* OBSERVATIONS

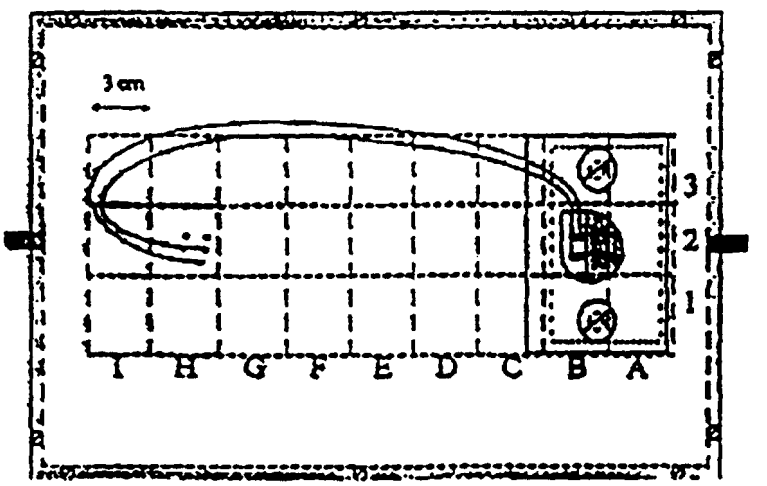
V. Barbaro, P. Bartolini, A. Donato, G. Militell

Istituto Superiore di Sanità, Rome, Ital

TORSO MODEL AND EXPERIMENTAL SETUP



(A)



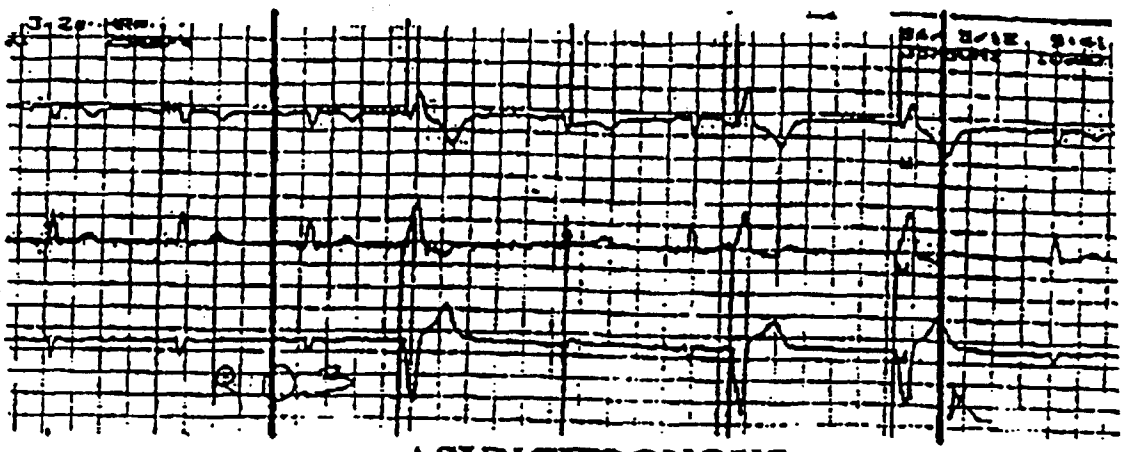
(B)

(A) SIDE VIEW, (B) TOP VIEW

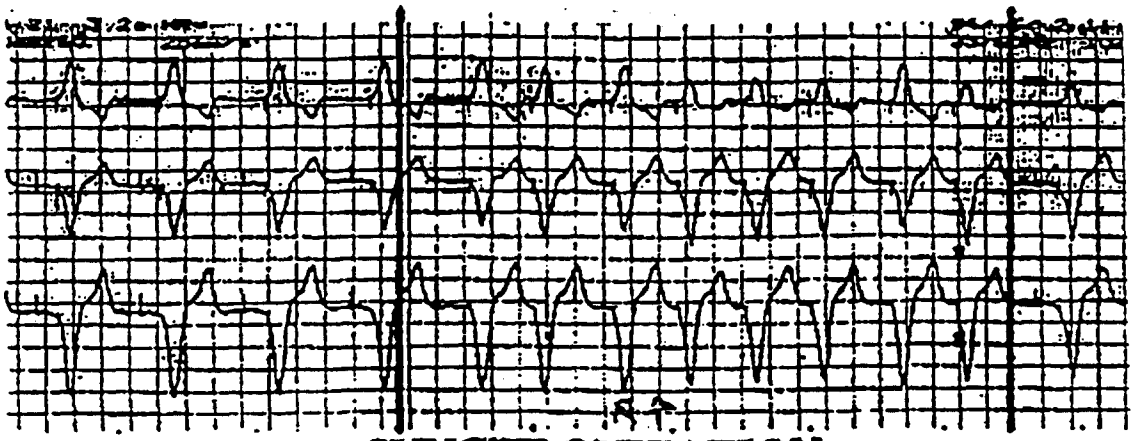
IN VIVO EFFECTS

RINGING

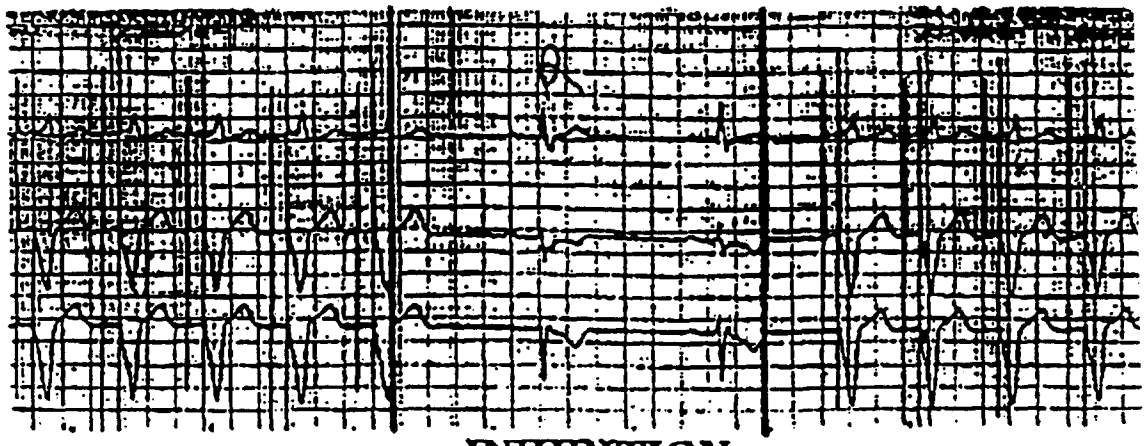
STOP RINGING



ASYNCHRONOUS



SYNCHRONIZATION



INHIBITION

IN VITRO RESULTS

BIOTRONIK						
ERGOS 02	DDD	IN-SY	0.6	3	11.0	9.0
			2.0	0.8	10.0	4.0
GEMNOS 03	DDD	NE	—	—	—	—
PHYSIOS 01	DDD	NE	—	—	—	—
CPI						
VIGOR DR 7250	DDD	NE	—	—	—	—
VISTA DDD 940	DDD	NE	—	—	—	—
ELA MEDICAL						
CHORUS RM 7034	DDD	SY	0.4	2.5	1.5	1.0
CHORUS 6043	DDD	IN-SY	0.4	3.5	3.6	2.0
			1.2	3.0	0.6	0.3
OPUS 4033	SSI	NE	—	—	—	—
MEDICO ZEN						
PHYMOS ADV	VDD	AS	0.15	1.0	1.5	1.0
			0.3	0.8	1.0	0.6
PHYMOS MPS	VDD	AS	0.15	3.0	3.6	2.3
			0.3	2.5	3.0	1.3
KERFOS X4P	SSI	IN-AS	HIGH	0.7	0.6	0.3
MEDTRONIC						
LEGEND PLUS	SSI	AS	0.65	0.5	0.5	0.7
MINUET 7104	DDD	SY	0.5	2.5	2.5	2.0
			1.0	2.0	1.0	0.8
SYNERGYST 7021	DDD	IN-SY	0.5	1.0	1.0	0.5
			1.0	0.5	0.6	0.3
7001	DDD	NE	—	—	—	—
SIEMENS						
2010T	SSI	AS	0.5	1.0	1.3	1.2
			1.2	0.6	0.8	0.5
2024T	SSI	AS	0.5	1.2	0.8	0.5
			0.8	0.5	0.5	0.3
2037T	SSI	NE	—	—	—	—
SORIN						
LIT 620A	SSI	IN-AS	2.1	2.0	1.5	1.2
MINIOR 100	SSI	NE	—	—	—	—
NEWCOR 50	DDD	NE	—	—	—	—
PHYSIOCOR 4001	DDD	SY	0.6	1.3	1.0	0.6
			1.2	0.5	0.5	0.3
SWING 200	SSI	NE	—	—	—	—
SWING DR1	DDD	NE	—	—	—	—
SWING VDR1	DDD	NE	—	—	—	—
THEOREMA 90	SSI	NE	—	—	—	—
VITATRON						
CERIX 6	SSI	IN-SY-AS	1.0	2.5	2.5	1.5
			2.0	2.0	1.6	1.0

NE = NO EFFECT AS = ASYNCHRONOU
SY = SYNCHRONIZATION IN = INHIBITION

IN VIVO RESULTS

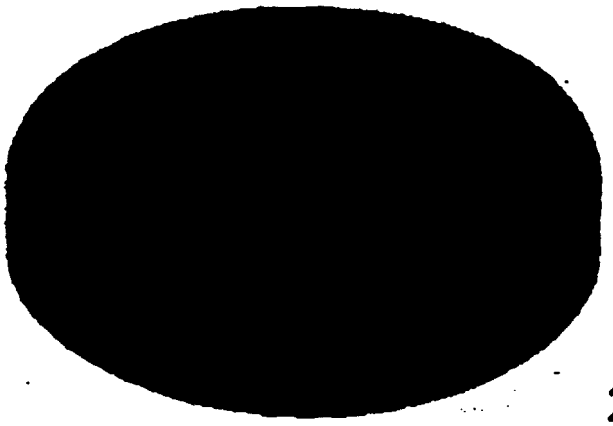
SORIN					
LIT 620/A	VVI	IN	2.1	4.0	0.3
MICROPACER	VVI	NE	0.8	0.5	
MICROPACER 1	VVI	NE	0.8	0.5	
ORION 40	VVI	AS	2.0/4.0	0.5	1.3/0.3
ORION 65	VVI	NE	0.6	0.5	
ORION 65C	VVI	NE	0.6	0.5	
SIGMACOR LIT 650/B	VVI	NE	2.3	0.5	
SWING 100	AAI	NE	0.8	4.0	
SWING 100	AAI	NE	0.8-1.6	1.5	
SWING 200	VVI	IN	0.5	1.0	0.3
SWING 200	VVI	IN	0.5	2.0	0.3
SWING 200	AAI	IN	0.5	0.5	2.5
THEOREMA 90	VVI	IN	0.7	0.3	9.0
THEOREMA 90	VVI	NE	0.7	0.5	
THEOREMA 90	VVI	NE	0.7	0.5	
TELEGTRONICS					
AURORA	DDD	NE	0.7-2.8	0.5	
OPTIMA MPT	AAI	NE	1.8	1.0	
OPTIMA MPT	VVI	NE	0.7	0.5	
OPTIMA-MP	AAI	IN	2.3	0.5	2.0
OPTIMA-MP	VVI	NE	2.5	1.5	
REFLEX 8220	VVI	NE	1.0	1.0	
REFLEX 8223E	DDD	NE	0.3-1.0	1.0	
REFLEX 8223E	DDD	NE	0.3-1	1.0	
REFLEX 8223E	DDD	NE	0.3-1.0	?	
REFLEX 8223E	DDD	NE	0.3-1.0	0.5	
REFLEX 8223E	DDD	NE	0.3-1.0	0.5	
REFLEX 8223E	DDD	NE	0.3-1.0	1.0	
REFLEX 8223E	DDD	NE	0.3-1.0	0.5	
REFLEX 8223E	DDD	NE	0.3-1.0	0.5	
REFLEX 8223E	DDD	NE	0.3-1.0	0.5	
REFLEX 8223E	DDD	NE	0.3-1.0	1.5	
REFLEX 8223E	DDD	NE	0.3-1.0	1.5	
REFLEX 8224	DDD	NE	1.0-2.0	0.5	
REFLEX 8224	DDD	NE	0.3-1.0	0.5	
REFLEX 8224	DDD	NE	0.3-2.8	3.0	
VITATRON					
CERIX 6	VVI	IN	1.0/2.0	0.5	3.5/2.0
CERIX 6	AAI	IN	1.0	1.0	0.3
DPG 921	VVI	NE	1.0	0.5	
QUINTECH 931	DDD	SY	0.5-1.0/1.0-1.0	0.5	1.3/0.3

IN VIVO RESULTS

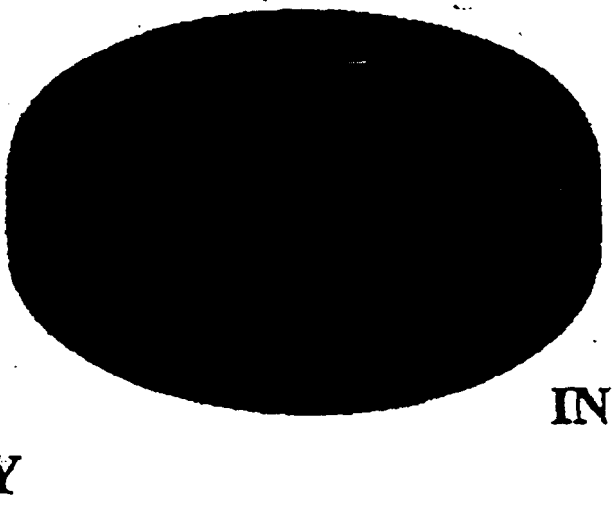
PMK					
BIOTEC					
978 MP	VVI	AS	2.0	3.0	3.0
BIOTRONIK					
PHYSIOS TC 01	DDD	NE	0.5-1.5	0.5	
PHYSIOS TC 01	DDD	NE	0.5-1.0	2.0	
PHYSIOS TC 01	DDD	NE	0.5-0.5	1.0	
CORDIS					
MULTICOR Y	VVI	NE	2.5	2.0	
INTERMEDICS					
COSMOS II	DDD	NE	0.5-1	0.5	
COSMOS II	DDD	NE	0.5-1.0	2.0	
COSMOS II	DDD	NE	0.5-1.5	1.0	
COSMOS II	DDD	NE	0.5-1.0	1.0	
COSMOS II	DDD	NE	0.5-1.0	1.0	
COSMOS II	DDD	NE	0.5-1.0	0.5	
COSMOS II	DDD	NE	0.5-1.0	0.5	
COSMOS II	DDD	NE	0.5-1.0	2.0	
COSMOS II	DDD	SY	0.5-1.0	0.5	0.3
COSMOS II	DDD	SY	0.5-1.0	0.5	0.3
COSMOS II	DDD	SY	0.5-1.0/1.0-1.0	0.5	6.0/2.0
COSMOS II	DDD	SY	0.5-1.0/1.0-1.0	0.5	1.0/0.6
COSMOS II	DDD	SY	0.5-1.0	0.5	0.3
COSMOS II	DDD	SY	0.5-1.0	0.5	0.3
CYBERLITH 259	VVI	AS	2.0	0.5	2.0
NOVA II	AAI	NE	0.6	0.5	
MEDICO					
KERFOS X6P	VVI	AS	HIGH/LOW	1.0	3.3/1.0
PHYMOS ADV	VDD	AS	0.15-3.0/0.3-3.0	0.8	1.5/1.0
MEDTRONIC					
7076	DDD	SY	0.5-2.5/1.0-2.5	1.0	2.0/1.0
LEGEND 8419	VVI	NE	0.62	0.5	
SPECTRAX SXT	VVI	NE	1.25	4.0	
SPECTRAX SXT	VVI	NE	1.25	1.5	
SPECTRAX SXT	VVI	NE	1.25	1.5	
SYMBIOS 7005	DDD	IN	0.6-1.25/2.5-2.5	0.5	6.3/4.0
SYMBIOS 7005	DDD	NE	0.6-1.25	0.5	
SYNERGYST 7071	DDD	SY	0.5-1.25/2.0-2.0	0.2	0.3/0.3
THERA 8948	VDD	IN	0.25-1.0/1.0-1.0	0.5	10.0/4.0
THERA 8948	VDD	IN	0.25-1.0/0.5-1.0	0.5	4.0/2.0
THERA DR 7940	DDD	IN	0.5-1.0/1.0-1.0	0.5	3.0/2.0
VERSATRAX 7000	DDD	NE	0.75-1.25	0.5	

RESULTS

IN VITRO



IN VIVO
(for PMK implanted model)



CONCLUSIONS

- *PACEMAKERS WERE PROGRAMMED TO SIMULATE THE WORST CASE CONDITION (MAXIMUM SENSITIVITY). THE EFFECTS WERE ALSO OBSERVED AT LOWER SENSITIVITY.*

- *REPEATABLE EMI EFFECTS WERE DETECTED.*

- *THE EFFECTS WERE DETECTED IN CLOSE PROXIMITY OF EACH PACEMAKER.*

- *ONCE THE SOURCE OF INTERFERENCE WAS REMOVED, NO PERMANENT MALFUNCTIONING, OR ALTERED REPROGRAMMING, OR SIGNIFICANT CHANGES IN THE PROGRAMMED PARAMETERS WERE DETECTED.*

- *A GOOD AGREEMENT BETWEEN IN VIVO AND IN VITRO EXPERIMENTS WAS OBSERVED.*

- *ONLY TWO PHONE MODELS WERE TESTED.*

- *CELLULAR PHONES HAVE APPROXIMATELY 10,000 POSSIBLE OPERATING CONDITIONS (DEPENDING ON POWER LEVEL, TRANSMISSION CHANNEL AND TIME SLOT) WHICH CANNOT BE CONTROLLED BY THE USER, THEREFORE THE EFFECTS COULD BE MORE IMPORTANT THAN THE ONE WE ASSESSED.*

- *THE OBSERVED EFFECTS SUGGEST THAT SUCH KIND OF EMI COULD BE DANGEROUS FOR PACEMAKER DEPENDENT PATIENTS.*

EFFECTS OF TDMA-MODULATED HAND-HELD TELEPHONES ON PACEMAKERS

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Content

- Introduction
- Experimental set-up
- Basic conditions: Pacemakers
  Mobile phones
- Experiment
- Test results
- Conclusions

Swiss Telecom PTT

Introduction

Mobile phones using TDMA (Time Division Multiple Access):

Advantage: More than one user per RF-carrier

Disadvantage: Digital amplitude modulation has high interference potential.

Implications:

- Direct biological effects postulated
- Indirect "biological" effects found:
    - Medical implants
    - Hearing aids
    - Electronic equipment in hospitals

Two-way approach:

- Sample study on implanted pacemakers (completed)
- Laboratory measurements on the same pacemaker models to evaluate the electromagnetic field parameters (started)

Experimental set-up

Sample study

- 39 patients with representative distribution of pacemaker models implanted during the last 8 years.
- Test for **interference/non-interference**.
- State Hospital Basel, Cardiology Dept.

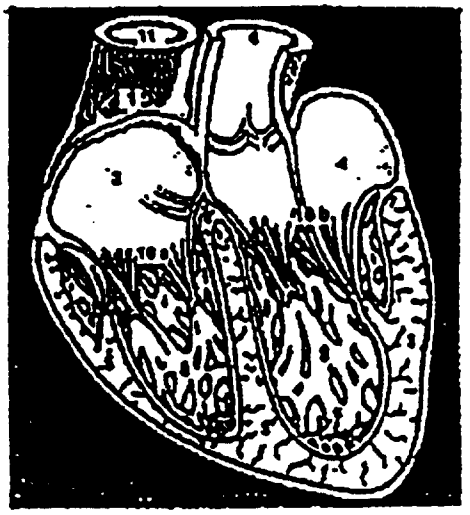
Laboratory study

- Follow-up study with classical EMC-measurements on the same pacemaker models in anechoic chamber.
- Pacemakers mounted on phantom.
- Monitoring of operation via optical sensing of the pulse at the stimulation electrode.
- Possibility of adding other mobile equipment standards (PCN, DECT, etc.).

Basic conditions

Implanted Pacemakers

Number tested	Operating mode	Product name
8	VDD	Unity
7	DDD	Cosmos
7	DDD	Paragon
7	VVI/M/R	Legend
5	VVIR	Meta
5	VVIR	Dash



Hand-held telephones

- TDMA (GSM) modulation: 8 logical channels per RF carrier
- 4 Models: 3 hand-held, 1 portable
- Power output (peak) 2 Watt (portable 8 Watt)
- Normal operation/ DTX (energy saving mode)
- Artificial base station for stable conditions